National Institute of Environmental Health Sciences

Spatial distribution and temporal variability of arsenic in irrigated rice fields in Bangladesh. 2. Paddy soil

Author(s): Dittmar J, Voegelin A, Roberts LC, Hug SJ, Saha GC, Ali MA, Badruzzaman ABM, Kretzschmar R

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Abstract:

Arsenic-rich groundwater from shallow tube wells is widely used for the irrigation of boro rice in Bangladesh and West Bengal. In the long term this may lead to the accumulation of As in paddy soils and potentially have adverse effects on rice yield and quality. In the companion article in this issue, we have shown that As input into paddy fields with irrigation water is laterally heterogeneous. To assess the potential for As accumulation in soil, we investigated the lateral and vertical distribution of As in rice field soils near Sreenagar (Munshiganj, Bangladesh) and its changes over a 1 year cycle of irrigation and monsoon flooding. At the study site, 18 paddy fields are irrigated with water from a shallow tube well containing 397 +/- 7 microg L(-1) As. The analysis of soil samples collected before irrigation in December 2004 showed that soil As concentrations in paddy fields did not depend on the length of the irrigation channel between well and field inlet. Within individual fields, however, soil As contents decreased with increasing distance to the water inlet, leading to highly variable topsoil As contents (11-35 mg kg(-1), 0-10 cm). Soil As contents after irrigation (May 2005) showed that most As input occurred close to the water inlet and that most As was retained in the top few centimeters of soil. After monsoon flooding (December 2005), topsoil As contents were again close to levels measured before irrigation. Thus, As input during irrigation was at least partly counteracted by As mobilization during monsoon flooding. However, the persisting lateral As distribution suggests net arsenic accumulation over the past 15 years. More pronounced As accumulation may occur in regions with several rice crops per year, less intense monsoon flooding, or different irrigation schemes. The high lateral and vertical heterogeneity of soil As contents must be taken into account in future studies related to As accumulation in paddy soils and potential As transfer into rice.

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Resource Description

Exposure :

weather or climate related pathway by which climate change affects health

Extreme Weather Event, Food/Water Quality, Food/Water Quality

Extreme Weather Event: Flooding

Food/Water Quality: Chemical, Chemical, Other Water Quality Issue, Other Food Quality

Water Quality (other): Arsenic

Food Quality (other): Arsenic

Geographic Feature: ☑

resource focuses on specific type of geography

Freshwater, Other Geographical Feature

Other Geographical Feature : Subtropical

Geographic Location: ☑

resource focuses on specific location

Non-United States

Non-United States: Asia

Asian Region/Country: Other Asian Country

Other Asian Country: Bangladesh

Health Impact: ☑

specification of health effect or disease related to climate change exposure

Cancer

Mitigation/Adaptation: ☑

mitigation or adaptation strategy is a focus of resource

Adaptation

Resource Type: ☑

format or standard characteristic of resource

Research Article

Timescale: ☑

time period studied

Time Scale Unspecified

Vulnerability/Impact Assessment: ☑

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content